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Chemical composition and free radicals restraining activity of extracts from three *Manglietia* species leaves

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Abstract: The extracts from leaves of *Manglietia insignis* (Wall) Blume, *Manglietia chingii* Dandy and *Manglietia yuyuanensis* Law were prepared by organic solvent extraction and their components were analyzed by GC/MS and quantified. Meanwhile, the free radicals restraining activities were detected. The 21 compounds in *M. insignis,* 36 compounds in *M. chigii* and 20 compounds in *M. yuyuanensis* were identified. There were 11 common components in the extracts from three *Manglietia* species, and 12 components in two *Manglietia* species. The results of relative contents of every component in three extracts showed that the main constituents of *M. insignis* were terpenoids and alkene, amounting to 38.93%, followed by alkane (28.18%), the nitrogen containing compounds (15.73%) and aromatic compounds (7.23 %). The main constituents of leaf extract from *M. chingii* were the terpenoids and alkene, carboxylic acid, alkane and aromatic compounds, amounting to 30.22%, 14.17%, 13.87% and 13.29%, respectively. The main constituents of *M. yuyuanensis* were alcohol compounds, the terpenoids and alkene, and aromatic compounds, amounting to 28.00%, 25.38% and 18.00% respectively. The results showed that the three extracts had strong function of restraining oxygen free radicals. The ultra oxygen anions activity was restrained at the highest level, when the three extracts were diluted by hundred-fold, whereas the restraining capacity of hydroxyl free radicals reached maximum, when the three extracts were diluted by twenty-fold. The above results provide scientific evidences for further approaching the ecological healthy function of three *Manglietia* species

Keywords: *Manglietia*; Extracts; Chemical components; Free radicals restraining activity

Introduction

The plants in *Manglietia* are important evergreen broadleaf trees in *Magnoliaceae.* They have good shapes and luxuriant branches as well as leaves, being excellent afforesting trees. In researches of *Manglietia*, He *et al.* (2004) detected the drought resistance of *M. insignis*. Zhong *et al*. (2006) carried out the comparative analysis of the chemical composition of essential oils from five *Magnoliaceae* plants, including wild *M. yuyuanensis* growing in Nanling National Nature Reserve of Guangdong Province, and tested their antioxidant effectiveness. Now it is known that the natural plants contain some antioxidant components (Lebeau *et al.* 2000; Sun *et al.* 2005). Of which, certain reducing substances may eliminate free radicals or inhibit free radical reaction by antioxidation in the body of organism so as to reduce or block the damages of free radical oxidation to the body. The substances also play a very important role in the prevention and therapy of certain diseases. These natural antioxidants are similar to many antioxidant substances in the human body, which may repress such types of active oxygen as ultra oxygen anions (O_2^-), hydroxyl free radicals (·OH) and H_2O_2 under the environment simulating the human body. Chyau *et al.* (2006) obtained water extracts from three different color leaves of *Terminalia catappa* L and found that they had relatively higher scavenging action to hydroxyl free radicals (Chyau *et al*. 2006; He *et al.* 2006a and 2006b; He *et al.* 2007). The active oxygen free radicals play an important role in many physiological events of human body, such as signal transduction, inducing proliferation and differentiation, inducing apoptosis and so on. However, excessive oxygen free radicals may injure cells, Of which, ultra oxygen anion free radical (O_2^-) can be engendered by non-enzymatic and enzymatic reactions in aerobe, and leads to direct DNA damage of cells. Besides, hydroxyl free radical (·OH), another kind of active oxygen free radical has the strongest oxidation in cells and can be produced by many different ways. Therefore, ·OH has the greatest destructiveness to cells.

M. insignis, *M. chingii* and *M. yuyuanensis* were selected as materials in the present experiment and the extracts from the leaves were prepared by organic solvent extraction. Their components and relative contents were tested with the use of GC/MS and effects of the extracts on restraining oxygen free radical activities were also detected. Two indices for restraining ultra

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oxygen anions and hydroxyl free radicals were observed and compared with another two kinds of antioxidants (phytic acid (PA), the natural antioxidant, and n-propyl gallate (PG), the synthetic antioxidant). The free radical restraining activities of three kinds of leaf extract were explored in this study for the purpose of providing references for screening ecological healthy tree species in urban afforestation.

Materials and methods

Materials

M. insignis, M. chingii and M. yuyuanensis were collected from Jiangsu Forestry Academy of Science in May 2005. Phytic acid (PA: myo-inositol hexaphosphate, IP_6) was from Jiashan Jufeng Chemical Plant. It was diluted by water, and the experimental consistencies were 0.7% in experiment of restraining ultra oxygen anions and 3.5% in experiment of restraining hydroxyl free radicals. n-propyl gallate (PG), was from Sinopharm Reagent, It was dissolved and diluted by ethanol, and the experimental consistencies were 0.01mg·mL^{-1} in experiment of restraining ultra oxygen anions and 0.05 mg·mL^{-1} in experiment of restraining hydroxyl free radicals.

Preparation of extracts

Organic solvent extraction was employed with fresh leaves of 30g in weight being ground into powder after their air-drying (Liu *et al.* 1999). Then the powder was placed in a Soxhlet extractor for dipping in ethanol circumfluence. The ethanol circumfluence liquid was collected for removing educts by way of filtration, and after revolving evaporation, the light yellow extract from the filtrated liquid was obtained.

Analysis of components from extracts

GC/MS analysis was carried out on American Varian CP-3800; ChromPack Capillary Columns CP-Sil 19CB30 m, 0.25mm/0.25μm, Varian Saturn 2000. The volume of the sample injected was 0.6μl, the carrier gas He, drifting speed 0.8ml/min. The starting temperature of the program was at 50°C for 2 min and then the temperature was increased at the ratio of 3°C /min until 150°C, after that continuously increased at the ratio of 7°C/min until 240°C, keeping for 2 min; the temperatures of injection entrance and monitor were 230°C and 150°C, respectively. Ionization method used was EI, and electron energy was 70eV. The scanning method was used for gathering data and its range was 30–500amu. The total ion chromatograms were analyzed and compared with standard charts in computer. The percentage of the components was calculated through the method of normalizing GC peaks area.

Determination of restraining ultra oxygen anions of extracts in vitro

Determination of restraining ultra oxygen anions of extracts in vitro was carried out according to Nanjing Jiancheng Biological Engineering Institute Reagent kit.

The xanthine and xanthine oxidase reaction system were used to simulate the internal conditions of human body, which may produce ultra oxygen anion free radicals ($O_2^{\cdot-}$). With the addition of the electron transduction substances and gress chromogenic reagent, the reaction system appeared purplish red and its absorbance can be detected with the use of visible spectrophotometer. With Vc being taken as the standard and distilled water as control, the effect of samples on $O_2^{\cdot-}$ can be calculated. All the three extracts were set in the reaction system with dilution at 20, 50 and 100 times, respectively, and repeated for five times. In the reaction system, one activity unit was defined as the variation value of the inhibited ultra oxygen anion free radicals per liter of sample for the duration of 40 min at the temperature of 37°C being equivalent to the ultra oxygen anion free radicals inhibited by V_C of 1 mg. The calculation formula was as follows:

One activity unit (U/L)=($OD_{control}$-$OD_{determing}$)/($OD_{control}$ –$OD_{standard}$)×standard consistency (0.15mg/ml)×1000ml×diluted times before sample detected.

Determination of restraining hydroxyl free radicals in vitro

The method was carried out according to Nanjing Jiancheng Biological Engineering Institute Reagent kit.

In the Fenton reaction, the amount of H_2O_2 produced is directly proportionate to that of hydroxyl ($\cdot OH$). With the addition of electron receptor, the reaction system can produce a kind of red substance with the use of gress reagent for color indication. The color indication is also directly proportionate to the amount of the produced $\cdot OH$. Its activity can be detected by colorimetry.

The extracts with the same multiplication of dilution as mentioned above were placed in the reaction system with distilled water being taken as control. One activity unit was defined as the decrease of H_2O_2 concentration by 1 mmol/L per liter of sample for the detection duration of 1 min at the temperature of 37°C. The calculation formula was as follows:

One activity unit(U/ml)=($OD_{control}$ − $OD_{determing}$)/($OD_{standard}$ − OD_{blank})×consistency standard(8.824mmol/L)×1ml/sampling volume×diluted times before sample detected

Statistics analysis

F-test was adopted as analysis of variance.

Results and discussion

The total ion chromatogram of three extracts

The total ion chromatogram of three extracts was shown as Fig. 1. After obtaining total ion chromatogram of extracts from leaves in three *Manglietia species*, the chemical components were identified. The percentages of components were calculated through the method of normalizing GC peaks area

The contents of each component in three extracts

The contents of each component in three extracts were shown in Table 1.

The components of extracts from the leaves of three *Manglietia* species were partial similar as shown in Table. 2. Of which, 21 compounds in *M. insignis,* 36 compounds in *M. chigii* and 20 compounds in *M. yuyuanensis* were identified. There were 11 common components extracted from the leaves of three *Manglitia species*, and 12 common components in two *Manglitia* species.

The relative contents of each component in three extracts were that the main constituents of *M. insignis* were terpenoids and

alkene and alkane, amounting to 38.93% and 28.18%, respectively; another two kinds of containing compounds nitrogen and aromatic amounted to 15.73% and 7.23%, respectively. The main constituents of the leaf extract from *M. chingii* were the terpenoids and alkene, amounting to 30.22%, followed by carboxylic acid, alkane and aromatic compounds, amounting to 14.17%, 13.87%, and 13.29%, respectively. The main constituents of the leaf extract from *M. yuyuanensis* were alcohol compounds and terpenoids and alkene, amounting to 28.00% and 25.38%, respectively, followed by aromatic compounds, amounting to 18.00%. It was reported that the phenol compounds in plants appeared the function of antioxidation. Among aromatic compounds in three *Manglitia species*, the phenol compounds had a certain proportion such as *M. insignis* 0.72%, *M. chigii* 5.64% and *M. yayuanensis* 1.02%. It was inferred from the above results that these phenol compounds played an important role in antioxidation of the plant body.

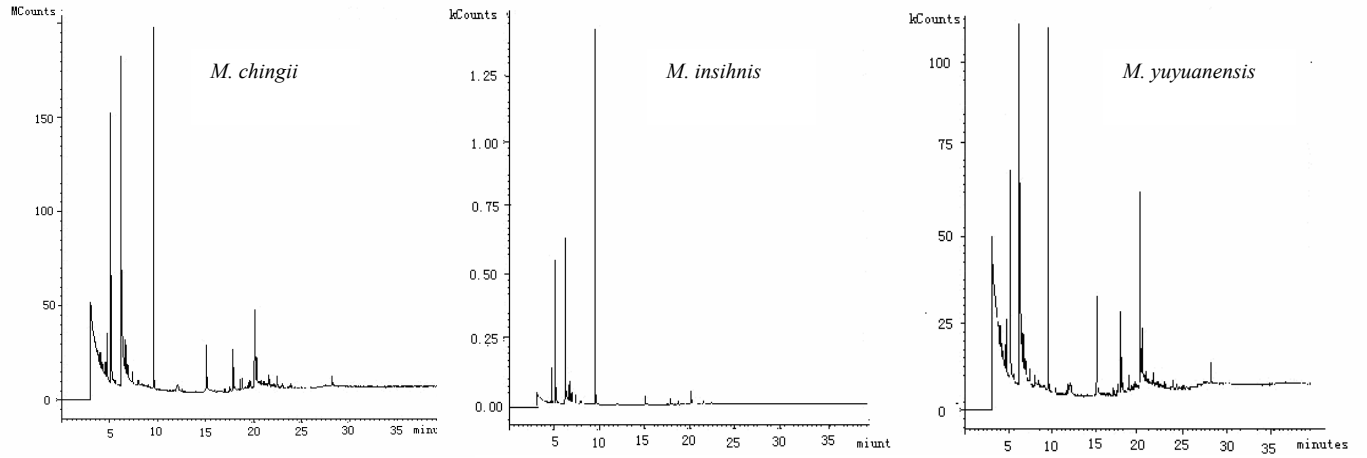

Fig1. The total ion chromatogram of chemical constituents of extracts from the leaves in *M. insignis*, *M. chingii* and *M. yuyuanensis*

Table 1. Chemical constituents of extract from *M. insignis, M. chingii* and *M. yuyuanensis* leaves

No.	Retention time/min	Compounds	Molecular formula	M.W.	Relative contents(%)
M. insignis					
1	3.037	2-Propanol,1-methoxy-	$C_4H_{10}O_2$	90	1.492
2	3.089	2,4,5,6,12,14,Acetic acid, methoxy-	$C_3H_6O_3$	90	5.906
3	4.033	Ethane,1,1-diethoxy-	$C_6H_{14}O_2$	118	0.232
4	4.584	Benzenemethanou, 3-hydroxy-	C_7H_8O	108	0.282
5	4.738	2,5-Norbormadiene	C_7H_8	92	4.171
6	5.085	Homoserine	$C_4H_9NO_3$	119	15.773
7	6.164	4-Methylenecyclopentene	C_6H_8	80	29.977
8	6.660	1,3-cyclopen tadiene,5-(1-methylethylidene)	C_8H_{10}	106	2.807
9	6.868	P-Xylene	C_8H_{10}	106	1.552
10	7.358	O-Xylene	C_8H_{10}	106	1.157
11	7.928	Cyclopentane,1,3-bis(methylene)	$C_9H_{14}O$	138	0.759
12	9.539	Decane	$C_{10}H_{22}$	142	27.453
13	15.077	4*H*-1-Benzopyran-4-one-3,5,7-trimethoxy-2-(4-methoxyphenyl)-	$C_{19}H_{18}O_6$	342	1.461
14	18.568	Dodecane,2,6,10-trimethyl	$C_{15}H_{32}$	212	0.195
15	18.749	Phenol,2,4,6-tris(1-methylethyl)-	$C_{15}H_{24}O$	220	0.464
16	19.600	Nerolido l	$C_{15}H_{26}O$	222	0.256
17	20.146	Santolina	$C_{10}H_{16}$	136	0.790
18	20.983	1-Decanol,2-hexyl-	$C_{15}H_{24}$	204	0.170
19	21.506	Hexadecane	$C_{16}H_{34}$	226	0.381
20	22.072	Nonadecane	$C_{19}H_4O$	268	0.149
21	23.783	Phenol,2-methyl-4-(1,1,3,3-tetramethylbutyl)	$C_{15}H_{24}O$	222	0.259
M. chingii					
1	3.037	2-Propanol,1-methoxy-	$C_4H_{10}O_2$	90	2.544
2	3.073	2,4,5,6,12,14,Acetic acid, methoxy-	$C_3H_6O_3$	90	7.440
3	3.152	2,3-Butanediol	$C_4H_{10}O_2$	90	5.713
4	3.245	(*S*)-2-Hydroxypropanoic acid	$C_3H_6O_3$	90	6.241

Continued Table 1

No.	Retention time/min	Compounds	Molecular formula	M.W.	Relative contents(%)
5	3.401	Propanoic acid,2-hydroxy-,ethyl ester(*S*)	$C_5H_{10}O_3$	118	1.941
6	3.495	Propane,1-(1-ethoxyethoxy)	$C_7H_{16}O_2$	132	0.488
7	3.557	2,4-Pentandiol	$C_5H_{12}O_2$	104	0.176
8	3.774	Ether, seo-butyl isopropyl	$C_7H_{16}O$	116	0.550
9	4.036	Ethane,1,1-diethoxy-	$C_6H_{14}O_2$	118	0.729
10	4.248	Propanoic acid,2-hydroxy-,ethyl ester	$C_5H_{10}O_3$	118	0.416
11	4.575	Benzenemethanol,3-hydroxy-	$C_7H_8O_2$	124	0.600
12	4.733	Toluene	C_7H_8	92	1.889
13	5.101	L-Alanine,ethyl ester	$C_5H_{11}NO_2$	117	11.463
14	6.016	4-Methylenecyclopentene	$C_2H_6O_4S$	126	26.223
15	6.648	1,3-Cyclopentadiene,5-(1-methylethycidene)	C_8H_{10}	106	1.303
16	6.852	P-xylene	C_8H_{10}	106	0.674
17	7.349	O-Xylene	C_8H_{10}	106	0.501
18	7.947	Bicyclo[2,2,1]hept-2-ene,2,3-dimethyl-	C_9H_{14}	122	0.387
19	9.532	Decane	$C_{10}H_{22}$	142	12.715
20	15.088	4*H*-1-Benzopyran-4-one,3-(3,4-dimethoxyphenyl)-6,7-dimethoxy-	$C_{19}H_{18}O_2$	342	3.400
21	17.441	Longifolene	$C_{15}H_{24}$	204	0.202
22	18.569	Dodecane,2,6,10-trimethyl-	$C_{15}H_{32}$	212	0.416
23	19.747	Phenol,2,4,6-tris(1-methylethyl)-	$C_{15}H_{24}O$	220	0.421
24	19.486	Phenol,2,6-bis(1,1-dimethylethyl)-4-ethyl-	$C_{16}H_{26}O$	234	19.487
25	19.600	Nerolidol 1	$C_{15}H_{26}O$	222	0.385
26	20.068	Phenol,2-methyl-4-(1,1,2,3-tetramethylbytyl)-	$C_{15}H_{24}O$	220	4.909
27	20.146	Santolina triene	$C_{10}H_{16}$	136	1.540
28	20.734	2-Hexyl-1-octansl	$C_{14}H_{30}O$	214	0.276
29	20.981	1-Decanol,2-hexyl-	$C_{16}H_{34}O$	242	0.301
30	21.175	1*H*-3a,5-Methanoazulene,oxtahydro-1,9,9-trimethyl-4-methylene-,(1,alpha,3a,al)	$C_{15}H_{24}$	204	0.063
31	21.271	1,4-Methanoazulen-9-ol,decahydro-1,5,5,8a-tetramethyl-,[IR-(1,alpha)]-	$C_{15}H_{26}O$	222	0.113
32	21.413	1-Dodecanol,3,11-trimethyl-	$C_{15}H_{32}O$	228	0.096
33	21.509	Hexadecane	$C_{16}H_{34}$	226	0.867
34	22.344	Dodecanoic,acid2-(acethloxy)-1-[(acethloxy)methyl]ethyl ester	$C_{19}H_{34}O_6$	358	0.492
35	22.859	Eicosane	$C_{20}H_{42}$	282	0.139
36	28.122	Trans-6-carboxy-2-(p-methoxystyryl)chromone	$C_{19}H_{14}O_5$	322	0.630
M. yuyuanensis					
1	3.039	5,2-Propanol,1-methoxy-	$C_4H_{10}O_2$	90	22.755
2	3.278	2,3-Pufanediol	$C_4H_{10}O_2$	90	3.599
3	3.388	Propanoic acid,2-hydroxy-,methyl ester	$C_4H_8O_3$	104	0.551
4	3.720	1,2-Propanediol diformate	$C_5H_8O_4$	132	0.695
5	4.034	Ethane,1,1-diethoxy	$C_6H_{14}O_2$	118	1.049
6	4.226	Propanoic acid,2-hydroxy-,ethyl ester	$C_5H_{10}O_3$	118	0.617
7	4.572	2-Propanol,1,-oxybis-	$C_6H_{14}O_3$	134	0.849
8	4.730	Toluene	C_7H_8	92	1.649
9	5.112	L-Alanine,ethyl ester	$C_5H_{11}NO_2$	117	10.290
10	6.184	4-Methylenecyclopentene	$C_2H_6O_4S$	126	24.356
11	6.647	1,3-Cyclopentadiene,5-(1-methylethylidene)-	C_8H_{10}	106	1.010
12	6.849	P-xylene	C_8H_{10}	106	0.509
13	7.347	O-xylene,	C_8H_{10}	106	0.427
14	9.531	Decane	$C_{10}H_{22}$	142	9.192
15	15.077	4*H*-1-Benzopyran-4-one-3,5,7-trimethoxy-2-(4-methoxyphenyl)-	$C_{19}H_{18}O_6$	342	4.954
16	18.566	Dodecane,2,6,10-trimethyl-	$C_{15}H_{32}$	212	0.664
17	18.746	Phenol,2,4,6-tris(1-methylethyl)-	$C_{15}H_{24}O$	220	0.524
18	19.488	Phenol,2,60bis(1,1-dinethylethyl)-4-ethyl-	$C_{16}H_{24}O$	234	0.480
19	21.510	1-Decanol,2-hexyl-	$C_{16}H_{34}O$	242	0.800
20	28.124	Trans-6-Carboxy-2-(p-methoxystyryl)chromone	$C_{19}H_{14}O_5$	322	1.015

Table 2. The similar constituents and their contents in three *Manglitia species*

No.	Compounds	*M .insignis*	*M. chingii*	*M. yuyuanensis*
1	2-Propanol,1-methoxy-	1.429	2.544	22.755
2	2,4,5,6,12,14,Acetic acid,methoxy-	5.906	7.440	
3	2,3-Butanediol		5.713	3.599
4	Ethane,1,1-diethoxy-	0.232	0.729	1.049
5	Propanoic acid,2-hydroxy-,ethyl ester		0.416	0.617
6	Benzenemethanou, 3-hydroxy-	0.282	0.600	
7	Toluene		1.889	1.649
8	L-Alanine,ethyl ester		11.463	10.290
9	4-Methylenecyclopentene	29.977	26.223	24.365
10	1,3-cyclopen tadiene,5-(1-methylethylidene)	2.087	1.303	1.010
11	P-Xylene	1.552	0.647	0.509
12	O- Xylene	1.157	0.501	0.427
13	Decane	27.453	12.715	9.192
14	4*H*-1-Benzopyran-4-one-3,5,7-trimethoxy-2-(4-methoxyphenyl)-	1.461	3.400	4.954
15	Dodecane,2,6,10-trimethyl	0.195	0.416	0.664
16	Phenol,2,4,6-tris(1-methylethyl)-	0.464	0.421	0.524
17	Phenol,2,6-bis(1,1-dimethylethyl)-4-ethyl-		0.311	0.480
18	Nerolido l	0.256	0.385	
19	Santolina	0.790	1.540	
20	1-Decanol,2-hexyl-	0.170	0.301	0.800
21	Hexadecane	0.381	0.867	
22	Phenol,2-methyl-4-(1,1,3,3-tetramethylbutyl	0.259	4.909	
23	Trans-6-carboxy-2-(p-methoxystyryl)chromone		0.630	1.015

The activities of restraining oxidation from three extracts, PA and PG

The activities of restraining oxidation from three extracts, PA and PG were shown as Table 3, 4 and 5.

Table 3. Activities of restraining ultra oxygen anions ($\times10^3$U/L)

Samples	Diluted times		
	×20	×50	×100
Control	0.0150±0.1030	0.0150±0.1030	0.0150±0.1030
M .insignis	6.9182±1.0050**	15.9567±1.1276**	24.7387±2.5486**
M .chingii	7.7030±0.3774**	6.6786±1.2425**	7.9310±2.1365**
M .yuyuanensis	4.2491±0.2771**	8.0277±1.8322**	12.4765±1.3931**

"*" means remarkable difference; "**" means very remarkable difference. $F_{0.01}$=21.1977; $F_{0.05}$=7.7086

Table 4. Activities of restraining hydroxyl free radicals ($\times10^2$U/L)

Samples	Diluted times		
	×20	×50	×100
Control	0.441±0.157	0.441±0.157	0.441±0.157
M .insignis	3.665±0.791**	3.523±0.347**	1.740±0.501*
M. chingii	5.163±0.105**	4.923±4.874**	0.770±0.1909
M. yuyuanensis	3.424±0.507**	0.564±0.1461	0.158±0.1461

Table 5. Free radicals restraining activities for PA and PG ($\times10^2$U/L)

Sampls	Activities of restraining oxygen anions	Activities of restraining hydroxyl free radicals
Control	0.0150±0.1030	0.4412±0.1567
PA	0.5887±1.1236	4.3460±0.1342
PG	5.9380±1.5420	4.4710±0.2574

The results of F-test showed that the activities of restraining oxygen free radicals from three *Manglitia* species appeared remarkable discrepancy as compared with the control. The researches indicated that when three extracts were diluted by hundred-fold, the activities of restraining ultra oxygen anions reached maximum. The activity order of restraining ultra oxygen anions from high to low was *M. insignis*, *M. yuyuanensis*, *M. chingii*, PG and PA. When three extracts were diluted by twenty-fold, the activities of restraining hydroxyl free radicals reached maximum. The activity order from high to low among them was *M. chingii*, PG, PA, *M. insignis* and *M. yuyuanensis.*

Free radicals are intermediate products produced from biochemical reactions of organism, including the oxygen free radicals and the free radicals arising from metabolism of foreign matters such as medicines in human body. In spite of their benefits to body sometimes, they may still become pathogenic in case of the existence of excessive oxygen free radicals, for instance, damage of blood vessels. In addition, they are closely related to senility of human body (Guo *et al*. 2006). Under the normal conditions, there is a dynamic balance between the generation and elimination of free radicals. If the surplus free radicals cannot be eliminated in a timely way, they may do harm to human body in terms of molecular, cellular and organic levels and accelerate senility of human body. It is known that as an inorganic free radical, the reactive oxygen species (ROS) are very reactive, and have considerable destructiveness. As a kind of ROS, the ultra oxygen anion ($O_2^{\cdot-}$) in cells not only causes DNA injure, but also inactivates catalase, glutathione peroxides and creatine kinases. Its cytotoxity rests with the production of H_2O_2 and hydroxyl free radical ($^{\cdot}OH$) by way of derivation. $^{\cdot}OH$, an oxidant is well known for the strongest activity. It reacts with organic or inorganic substances, almost including all cell components, and leads to lipid peroxidization or produces lipid peroxide, finally causing the greatest hazard to human body. In this experiment, two antioxidants were selected. As a kind of six phosphonolipids of inositol, phytic acid is hexa-organic phosphat of inositol and exists in most types of cereals, nuts and bean family plants (Ahn *et al*. 2004). It is a chelator and a good natural antioxidant with

the property of antioxidation, mainly resulting from its high action of iron ions chelation. As for n-propyl gallate (Xu *et al*. 2006), it is a kind of synthetic phenol compounds. Previous animal experiments identified that phenol compounds possessed the function of antioxidization. The main mechanism was that conjugate ring and hydroxyl group contained eliminated oxygen free radicals, while the carboxyl of PG inhibited lipid peroxidation by mediating metal ions. Moreover, phenol compounds can also inhibit the activities of lipid oxidase and epoxidase. At present, it has been found that some plant extracts provided with the function of antioxidation (Rodriguez-Meizoso *et al*. 2006; Hanson *et al*. 2006; Jayaprakasha *et al*. 2006). Of which, a great deal of them have been verified as fairly good natural antioxidants by way of animal experiments, thus becoming the natural resources of pharmaceutical researches and foodstuff industry. Results suggested that the three extracts exhibited relatively strong function as restraining $O_2^{\cdot-}$ and $^{\cdot}OH$ in vitro as compared with PA and PG,. Therefore, the study has opened up a broad prospect for applying the three *Manglitia species* .It can be inferred from the conclusion that the three plant species may provide natural resources as ecological healthy trees for constructing urban forest modes.

Conclusion

The extracts from three *Manglitia* species leaves were analyzed. Results showed that 21 compounds in *M. insignis*, 36 compounds in *M. chigii* and 20 compounds in *M. yuyuanensis* were identified. There were 11 common components in three extracts from *Manglietia* species, and 12 components in two *Manglietia species*. The results of relative contents of every component in three extracts showed that the main constituents of *M. insignis* were terpenoids and alkene, amounting to 38.93%, followed by alkane (28.18%), nitrogen compounds(15.73%) and aromatic compounds (7.23 %). The main constituents of leaf extract from *M. chingii* were the terpenoids and alkene, amounting to 30.22%, followed by carboxylic acid, alkane, and aromatic compounds, amounting to 14.17%, 13.87% and 13.29%, respectively. The main constituents of leaf extract from *M. yuyuanensis* were alcohol compounds, amounting to 28.00%, the terpenoids and alkene, 25.38% and aromatic compounds, 18.00%. The results showed that the activity of ultra oxygen anions was restrained at the highest level, when the three extracts were diluted by hundred-fold, whereas the restraining capacity of hydroxyl free radicals reached maximum, when the three extracts were diluted by twenty-fold.

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